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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Optically Transparent, Printable Labels

(72) Questel, John M. - U.S.A. ;
Dolence, Dale E. - U.S.A. ;

(73) Koch Label Company, Inc. - U.S.A. ;

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OPTICALLY TRANSPARENT, PRINTABLE LABELS

The present invention is directed toward a label which may be printed such that only the printing is visible; the label itself being optically clear. More particularly, the present invention relates to a multi-layer label which includes a polymeric film layer with a high water vapor transmission rate, and which employs a water-based adhesive with a high degree of solids.

In the beer, food packaging and cosmetic industries, it is desirable to apply printing or the like, to clear containers, such as glass or plastic bottles, such that only the printing itself is visible. It has been known to apply paper or foil laminate labels to containers to convey product information, but of course, such labels themselves are visible. However, it is felt that a "no label" look has greater consumer appeal.

To provide a container which is printed such that only the printing is visible, various techniques have been employed. For instance, it is known to apply a ceramic print to containers. This is known in the industry as an "applied ceramic label" and is essentially a direct silk screen process which is very expensive. In order to make such a system at all cost-effective, it is necessary that the containers be returnable and reusable. Even then, another drawback is that all of the containers are thereby pre-printed, making it difficult or impossible to change the printing when labeling requirements change. Thus, flexibility is severely curtailed. This can be a serious disadvantage in industries where labeling requirements frequently change due to regulatory or commercial requirements.

It is also known to provide a printed clear film layer with a pressure-sensitive adhesive covered with a release paper. In use, the release paper is peeled off and the label affixed to the container. These labels have also proven to be cost-prohibitive to produce when compared to standard paper or foil laminate labels. Furthermore, it has been found that these labels will not feed through standard labeling equipment, but require specialized equipment, thereby further increasing costs both because of the machinery cost and the fact that this machinery operates at about one-half the speed of more typical equipment.

A need exists, therefore, for an optically clear, printable label which may be fed by standard labeling machines and is capable of being adhered to a glass or plastic container.

Such a label must include a film which is of sufficient stiffness to be processed by conventional labeling and processing equipment. Also, static

buildup during processing and surface tension between stacked sheets must be avoided. Finally, it is necessary that the adhesive must be capable of drying clear.

It is an object of an aspect of the present invention to provide an optically clear label for a container.

It is an object of an aspect of the invention to provide such a label which may be printed.

It is an object of an aspect of the present invention to provide such a label employing an adhesive which will be optically clear when set.

It is an object of an aspect of the present invention to provide such a label which may be applied to a container using standard labeling equipment.

These and other objects of the invention, as well as the advantages thereof over existing and prior art forms, which will be apparent in view of the following detailed specification, are accomplished by means hereinafter described and claimed.

In general, an optically transparent label, according to the invention, comprises a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours. A transparent-drying adhesive layer is also included and has a high percentage of solids, as well as a printed image visible through the transparent label.

The adhesive, according to the present invention, comprises an emulsion blend. The blend includes from about 25% to 75% by weight of a vinyl acetate and ethylene copolymer. The blend also includes from about 25% to 75% by weight of a functionalized vinyl acetate copolymer.

The method of providing a glass or polymeric container with an optically transparent, printable label, according to the present invention, includes the steps of affixing a transparent film having a water vapor

transmission rate of that disclosed above to the container with a transparent-drying adhesive having a high percentage of solids and allowing the adhesive to coalesce.

Other aspects of this invention are as follows:

A multi-layer laminate comprising:

a) a container comprising a material selected from the group consisting of glass and polymeric materials;

b) a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours;

c) a transparent-drying adhesive having a high percentage of solids and bonded to said film layer and said container; and

d) a printed image layer.

A printed container comprising:

a) a container wall comprising a transparent material;

b) a transparent label;

c) said transparent label comprising a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours;

d) a transparent-drying adhesive having a high percentage of solids; and

e) a printed image visible through said transparent label.

A stack of static electricity buildup-inhibiting labels for use in a labeling machine, the stack comprising:

a) a plurality of multi-layer transparent labels; and

b) each said transparent label comprising a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours, a transparent-drying adhesive having a high percentage of solids, and an anti-static layer.

An exemplary, preferred embodiment of a label, according to the present invention, is shown by way of example in the accompanying drawings without attempting to show all the various forms and modifications in which the invention might be embodied, the invention being measured by the appended claims and not by the details of the specification.

OF THE DRAWINGS:

FIGURE 1 is a sectional view of a multi-layer label according to the present invention.

FIGURE 2 is a schematic diagram of a method of making the label of FIGURE 1.

FIGURE 3 is a side elevational view of a bottle having the label of FIGURE 1 affixed thereto.

FIGURE 4 is a side elevational view of a stack containing a plurality of labels of FIGURE 1.

The present invention is directed toward a multi-layer label generally indicated by the numeral 10 on the attached drawings. The layers of the label are exaggerated in FIGURE 1 for purposes of illustration. As will be hereinafter more fully discussed, the label 10 includes an anti-static layer 11, a transparent film layer 12, and an adhesive layer 13. Furthermore, a printed layer 14 is also included between adhesive layer 13 and film layer 12 . The printed layer 14 is applied to the transparent film 12 by any conventional method as is known in the art. A portion of a container 15 is also depicted in FIGURE 1 and is representative of a container such as a glass or plastic bottle and the like, with an entire exemplary bottle 15 being shown in FIGURE 3.

The anti-static layer 11 may consist of any material known in the art to degrade the effects of static electricity buildup. Labeling equipment will often move as many as 800 labels per minute or more, which may give rise to considerable amounts of static electricity, causing labels to stick together and otherwise causing misfeeds. The anti-static layer 11 of the present invention allows the labels to be fed by standard labeling machines without interference by static electricity. It will preferably reduce surface resistivity and be compatible with transparent film 12. Furthermore, anti-static layer 11 should also not affect the performance of printing ink on the label (i.e., by softening the ink or causing poor adhesion of the ink to the film.

Preferably, anti-static layer 11 is a cationic long chain quaternary ammonium compound (such as that commercially produced by ACL, Inc. and known as Staticide 100X Concentrate) having the ability to lower the surface resistivity of the label to about 10^9 ohms or lower, as measured by ASTM D-257. Other useful anti-static layers include cationic phosphonium or sulfonium compounds, as well as anionic alkyl sulphonic, phosphonic, dithio-

carbamic or carboxylic acids. Non-ionic antistats such as ethoxylated fatty amines, fatty acid esters or ethanolamides, polyethylene glycol-esters or -ethers, and mono- and di-glycerides are also useful in the practice of the invention.

The anti-static layer 11 shown in FIGURE 1 is exaggerated in thickness. In practice, any thickness which will provide anti-static properties is within the scope of the present invention.

Other means of controlling static electricity buildup may be employed in addition to anti-static layer 11. For example, an electret arrangement may be employed with the bottling machine as well as with the transparent film. Being a dielectric, the electret would inherently develop little or no static electricity.

It is to be understood that an anti-static layer 11 may be affixed to one or the other side of the transparent film layer 12, or even be affixed to both sides, and still be within the scope of the invention. FIGURE 1 shows the anti-static layer 11 on the outermost side of transparent film layer 12 away from the container 15 for exemplary purposes only.

As previously noted, the transparent film layer 12 is preferably stiff enough to be fed by a standard labeling machine, at least to a degree similar to a paper label, such paper labels being known in the art. Further, the film must be optically clear such that it is substantially transparent to light. Furthermore, it may have a translucent nature or a color such that it matches that of the container to which the label is to be applied. Any film which will not be visible when in place upon a particular container is within the scope of the present invention.

It is also preferred that the transparent film layer 12 be chosen with respect to the water vapor transmission rate thereof. By "water vapor transmission rate," it is meant the tendency of the material to allow water vapor to pass therethrough. For purposes of grading water vapor transmission rates, ASTM E96 is the industry accepted standard, which employs the units of grams/mil/100 square inches/24 hours at either 23°C or 37.8°C, and "mil" being one thousandth of an inch.

It has been found that by selecting a vapor transmissive film layer 12, which film has a water vapor transmission rate above about 4 grams/mil/100 square inches/24 hours, water from the adhesive (which will be discussed hereinbelow) is allowed to pass through the film and is not trapped thereby. For example, non-useful vapor transmissive films include polymeric films such

as polyethylene terephthalate, which has a water vapor transmission rate of 1.3, and will trap the water in the adhesive. This in turn will prevent the adhesive from coalescing, and the adhesive will generally remain milky and otherwise not optically clear.

A polymeric film having a water vapor transmission rate of at least about 4 grams/mil/100 square inches/24 hours, will allow the water in the adhesive to escape from the label 10, allowing the adhesive to coalesce and set so as to be optically clear. Table I contains a listing of useful polymeric films and their respective water vapor transmission rates. The listing in Table I is not exhaustive and is provided only for exemplary purposes.

TABLE I
EXEMPLARY VAPOR TRANSMISSIVE FILMS

Film	WVTR[a] at 26° C	WVTR[a] at 37.8°C
Cellulose propionate		254-899
Cellulose acetate butyrate	30-40	
Cellulose triacetate	10-40	
Cellulose diacetate	10-40	
Polyurethane		40-75
Nylon 6		16-72
Plasticized polyvinylchloride		5-40
Polycarbonate		11
Ethyl cellulose		4.8-14
Korad acrylic		8
Polystyrene		7-10
Vinyl acetate	4-8	

[a]Water vapor transmission rate measured by ASTM E96 in units of grams/mil/100 square inches/24 hours at temperature indicated.

Of the vapor transmissive films useful in the practice of the present invention, a high impact polystyrene layer of about 1 to about 3 mils is preferred because of its low cost, clarity, rigidity and processability.

The adhesive layer 13 of the present invention is selected for its ability to adhere to both the transparent film layer 12 and the container 15 to which

the label 10 is to be applied. Furthermore, the adhesive layer 13 is chosen for its ability to dry or "set" such that it is also optically clear. As was stated above, when the water of the adhesive is allowed to escape, the adhesive is more likely to coalesce and dry clear. Thus, the adhesive employed with the present invention is chosen based upon these criteria.

Furthermore, while the water-based adhesives disclosed herein are preferred, it will be appreciated by one skilled in the art that alcohol-based adhesives and other adhesives have applicability to and are within the scope of the present invention. The adhesive used will be chosen based upon its ability to dry so as to be optically clear.

It has been found that an adhesive having a high percentage of solids, such as from about 45 to about 70 percent by weight, will have less water. By having less water to be let off, it becomes easier for the adhesive to coalesce and become optically clear. It has also been found that an adhesive having a glass transition temperature below room temperature, and preferably about zero degrees celsius, will assure complete coalescence.

The preset adhesive includes micelle solid particles. Between the particles is water, toward which the charged surfaces of the particles are oriented. As water is removed by evaporation, and at some finite time, a continuous film may be formed if the glass transition temperature is below the ambient temperature, i.e, below about 0°C., as discussed hereinabove. The micelle particles come together to form a continuous film as water is evaporated (coalescence).

The adhesive layer 13 should also preferably have a set time of about 60 seconds or less in order to inhibit the labels 10 from sliding and becoming disoriented within the labeling machine. This, too, will allow labels 10, according to the invention, to be affixed to container 15 using standard labeling equipment.

One exemplary embodiment of an adhesive having the desired characteristics described hereinabove is a vinyl acetate copolymer functionalized with carboxylic acid blended with a copolymer of vinyl acetate and ethylene. The functionalized copolymer is a compound commercially available from Air Products and Chemicals, Inc. and is known as AIRFLEX 426 EXP. The vinyl acetate/ethylene copolymer is available from the same company as AIRFLEX 465. This polymeric blend emulsion contains a high percentage of solids and exhibits excellent adhesion to glass and polystyrene. Because these adhesive components are emulsions and not solutions, viscosity remains low even

ABSTRACT

An optically transparent label (10) includes a transparent film layer (12) having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours, a transparent-drying adhesive (13) having a high percentage of solids and a printed image (14) visible through the transparent label. An adhesive compound from an emulsion blend including from about 25 to about 75 percent by weight of a vinyl acetate and ethylene copolymer and from about 25 to about 75 percent by weight of a functionalized vinyl acetate. A method of providing a container (15) with a transparent label (10), a printed container (15) and a stack of static electricity buildup-inhibiting labels are also provided.

Claims:

1. An optically transparent label comprising:
   a) a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours;
   b) a transparent-drying adhesive having a high percentage of solids; and
   c) a printed image visible through the transparent label.

2. An optically transparent label as in claim 1, further comprising an anti-static layer comprising a material selected from the group consisting of long chain quaternary ammonium, phosphonium and sulfonium compounds; alkyl sulphonic, phosphonic, dithiocarbamic and carboxylic acids; ethoxylated fatty amines; fatty acid esters; fatty acid ethanolamides; polyethylene glycol-esters; polyethylene glycol-ethers; mono-glycerides; and diglycerides.

3. An optically transparent label as in claim 1, wherein said transparent film comprises a material selected from the group consisting of polystyrene homopolymer and copolymers, cellulose propionate, cellulose acetate butyrate, cellulose triacetate, cellulose diacetate, polyurethane, nylon 6, polyvinylchloride, polycarbonate, ethyl cellulose, vinyl acetate, and mixtures thereof.

4. An optically transparent label as in claim 1, wherein said adhesive comprises a vinyl acetate and ethylene copolymer and a functionalized vinyl acetate and ethylene copolymer.

5. An optically transparent label as in claim 4, wherein said functionalized copolymer is functionalized with a carboxylic acid.

6. An optically transparent label as in claim 1, wherein said adhesive has a glass transition temperature below about 0°C, to permit coalescence of said adhesive.

7. An optically transparent label as in claim 6, wherein said adhesive has a set time of less than about 60 seconds.

8. An optically transparent label as in claim 1, wherein said adhesive comprises from about 45 to about 70 percent by weight of solids.

9. An optically transparent label as in claim 1, further comprising a rough, clear lacquer layer.

10. An adhesive comprising an emulsion blend; said blend including from about 25 to about 75 percent by weight of a vinyl acetate and ethylene copolymer, and from about 25 to about 75 percent by weight of a functionalized vinyl acetate.

11. An adhesive as in claim 10, wherein said blend has from about 45 to about 70 percent by weight of solids.

12. An adhesive as in claim 10, wherein said functionalized vinyl acetate copolymer is functionalized with carboxylic acid.

13. A method of providing a glass or polymeric container with an optically transparent printable label comprising the steps of:

a) affixing a transparent film having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours to the container with a transparent-drying adhesive having a high percentage of solids; and

b) allowing said adhesive to coalesce.

14. A method as in claim 13, further comprising the step of affixing an anti-static layer to said transparent film.

15. A method as in claim as in claim 14, wherein said anti-static layer comprises a material selected from the group consisting of long chain quaternary ammonium, phosphonium and sulfonium compounds; alkyl sulphonic, phosphonic, dithiocarbamic and carboxylic acids; ethoxylated fatty amines; fatty acid esters; fatty acid ethanolamides; polyethylene glycol-esters; polyethylene glycol-ethers; mono-glycerides; and diglycerides.

16. A method as in claim 13, wherein said transparent film comprises a material selected from the group consisting of polystyrene homopolymer and copolymers, cellulose propionate, cellulose acetate butyrate, cellulose triacetate, cellulose diacetate, polyurethane, nylon 6, polyvinylchloride, polycarbonate, ethyl cellulose, vinyl acetate, and mixtures thereof.

17. A method as in claim 13, wherein said adhesive comprises a vinyl acetate and ethylene copolymer and a functionalized vinyl acetate and ethylene copolymer.

18. A method as in claim 17, wherein said functionalized copolymer is functionalized with a carboxylic acid.

19. A method as in claim 13, wherein said adhesive has a glass transition temperature below about 0°C, to permit coalescence of said adhesive.

20. A method as in claim 19, wherein said adhesive has a set time of less than about 60 seconds.

21. A method as in claim 13, wherein said adhesive has from about 45 to about 70 percent by weight of solids.

22. A method as in claim 13, further comprising the step of affixing a rough, clear lacquer layer to said transparent film.

23. A method as in claim 22, further comprising the step of printing an image onto said clear lacquer layer.

24. A multi-layer laminate comprising:

a) a container comprising a material selected from the group consisting of glass and polymeric materials;

b) a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours;

c) a transparent-drying adhesive having a high percentage of solids and bonded to said film layer and said container; and

d) a printed image layer.

25. A printed container comprising:
    a) a container wall comprising a transparent material;
    b) a transparent label;
    c) said transparent label comprising a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours;
    d) a transparent-drying adhesive having a high percentage of solids; and
    e) a printed image visible through said transparent label.

26. A stack of static electricity buildup-inhibiting labels for use in a labeling machine, the stack comprising:
    a) a plurality of multi-layer transparent labels; and
    b) each said transparent label comprising a transparent film layer having a water vapor transmission rate of at least 4 grams/mil/100 square inches/24 hours, a transparent-drying adhesive having a high percentage of solids, and an anti-static layer.

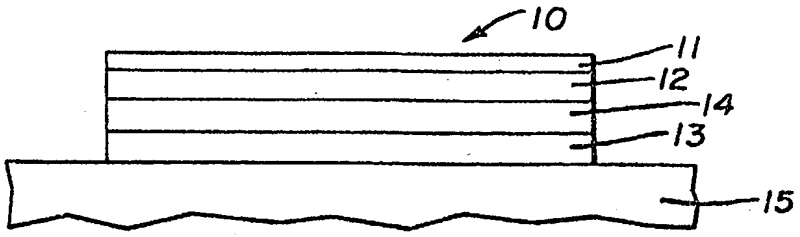
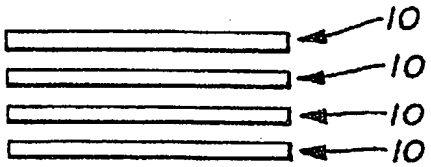


FIG. 1

FIG. 4



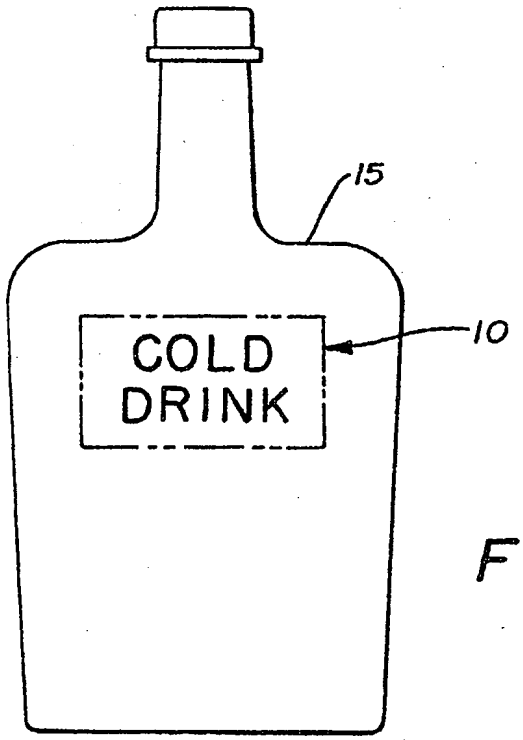


FIG. 3

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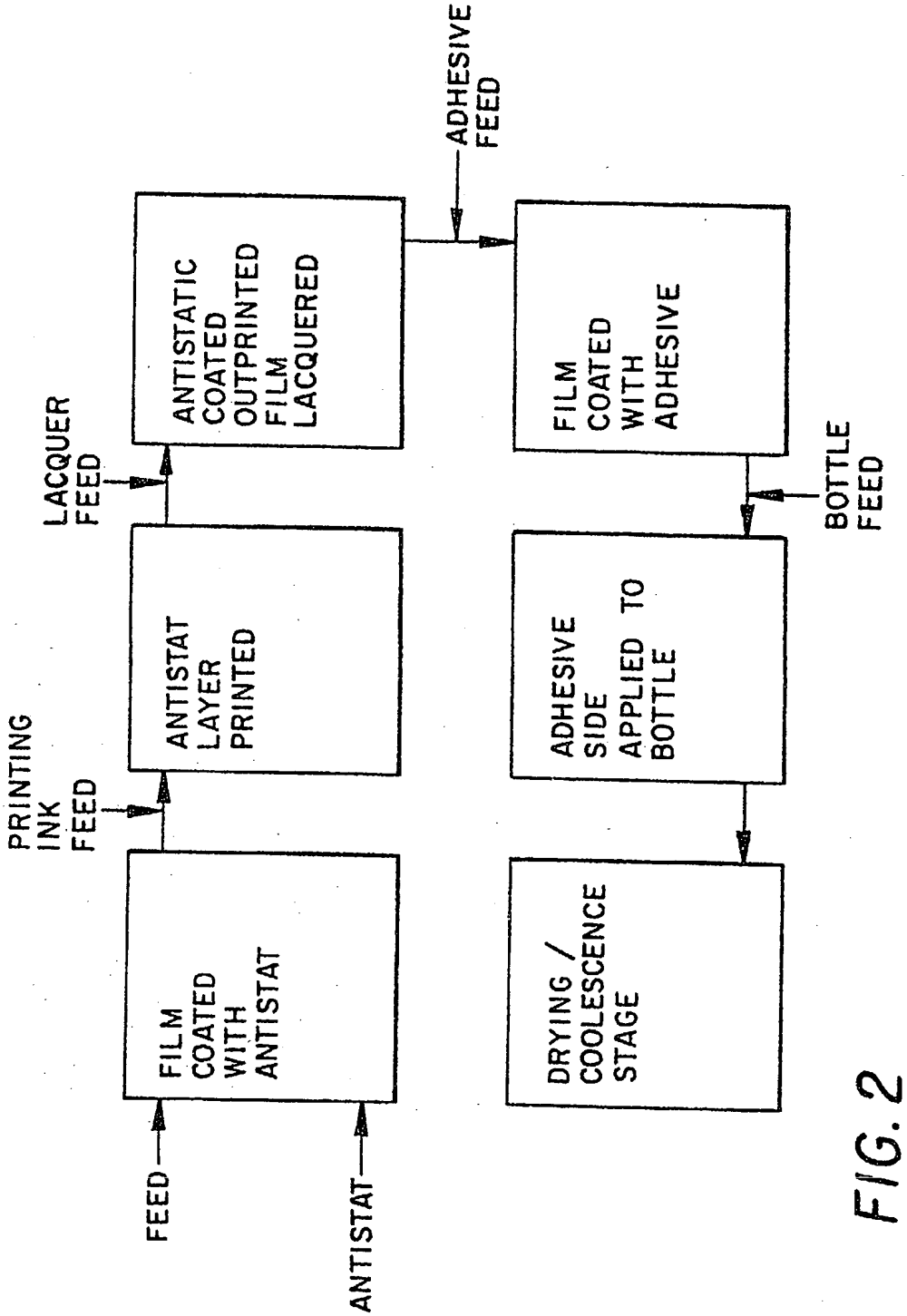

FIG. 2

Simon M. Bennett